

Evaluating the added value in regional climate model simulations of extreme temperatures in India

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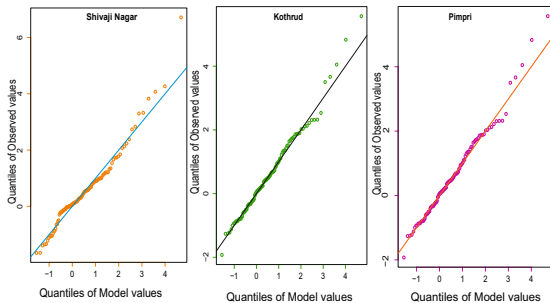
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Background

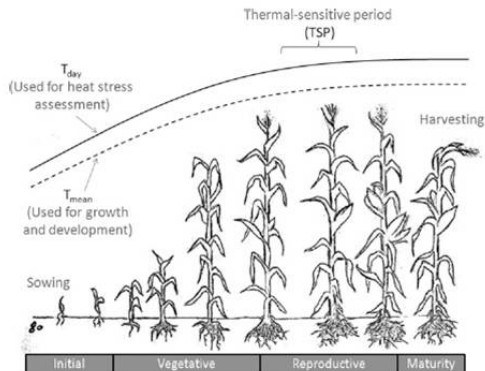
- Precipitation and temperature are the most important variables for impact studies.
- Quality controlled data of these variables to an appropriately dis-aggregated scale is the need of the end-users, which is really difficult to get in Indian context.
- One of the major objective of end-users is to address the likely impact of climate variability and climate extremes, at a localized scale, using observed data or projected climate data under different scenarios.
- There has been more focus on precipitation downscaling (both mean and extreme states) and less focus on other variables. Particularly temperature extreme which has been found to be an important variable to suggest impact in human systems.

Impact of extreme temperatures in peak electricity demand in Pune



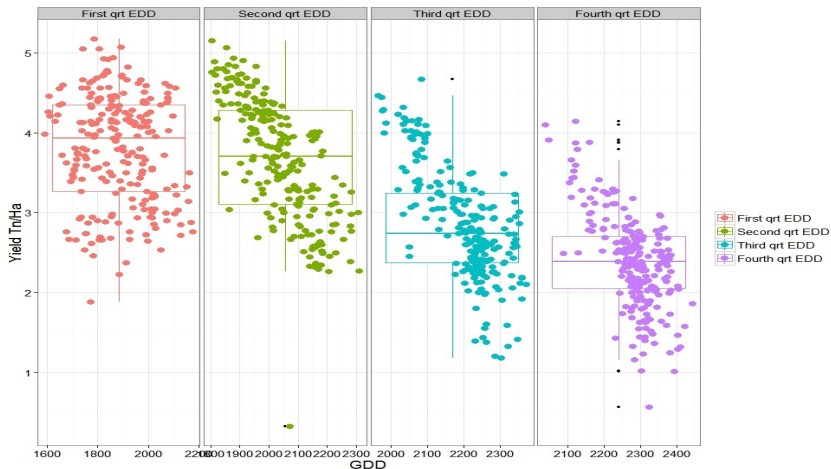
Daily temperature variability and relative humidity are useful data to address temperature-electricity relationship

Impact of extreme temperature on wheat yields: conceptual framework



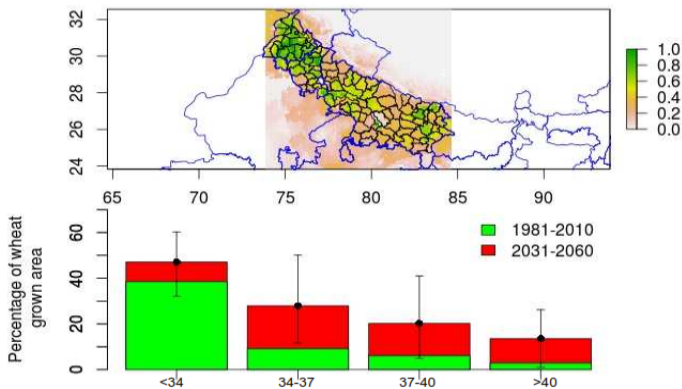
Exposure to extreme temperatures during reproductive period might influence the crop yield and production.

Impact of extreme temperature on wheat yields



Simulation of daily temperature values are useful to assess exposure to GDDs and EDDs.

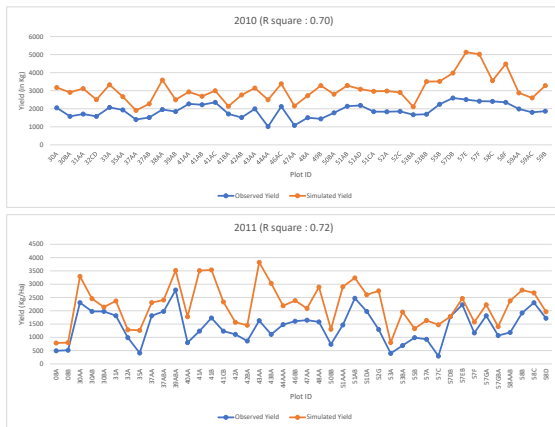
Regional model's simulation of extreme temperature in IGP region



RCMs show a large uncertainty in simulating area exposed to critical temperature of wheat

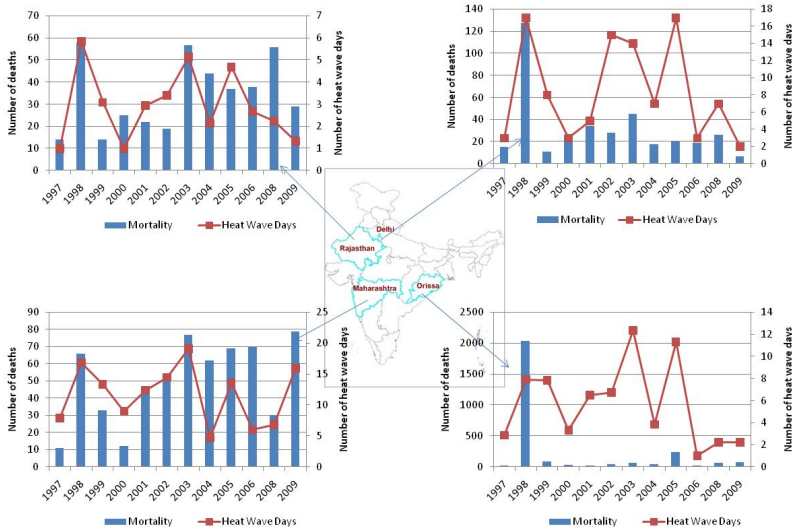
Exposure of extreme temperature on plot level yields

Observed Vs Simulated Wheat Yield (Papda, Raisen 2009-10 to 2013-14)



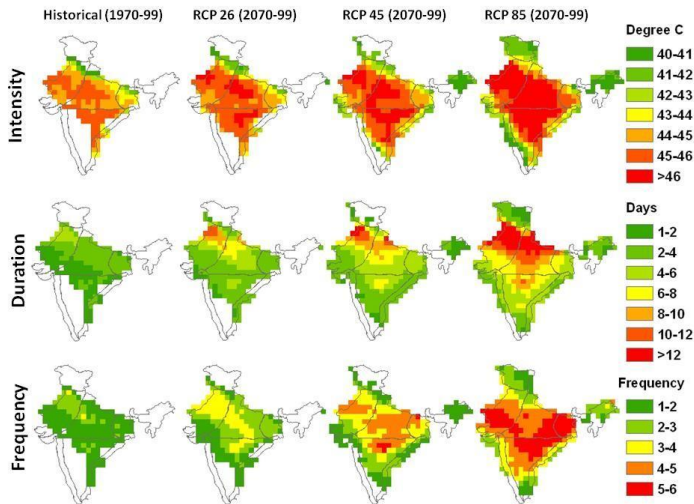
Temporal simulation of daily temperature records are useful to estimate GDDs and EDDs, which are useful to estimate plot-wise exposure to

The relationship of heat wave and mortality



Source: Murari et al., 2015

Projection of heat wave characteristics in India

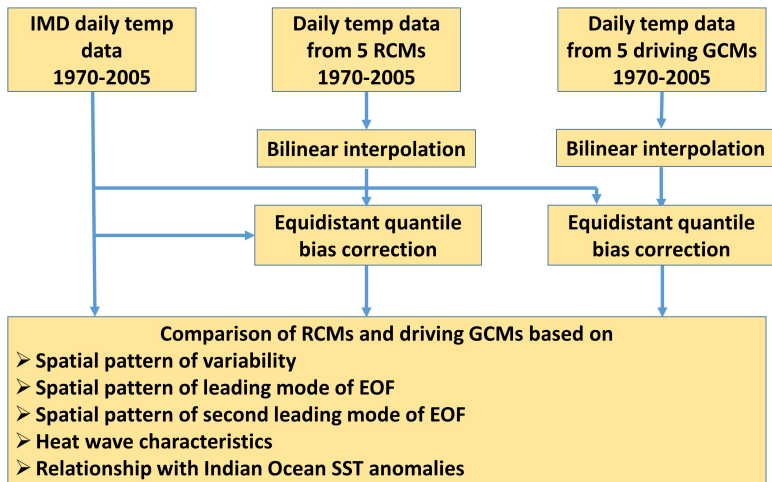


Source: Murari et al., 2015

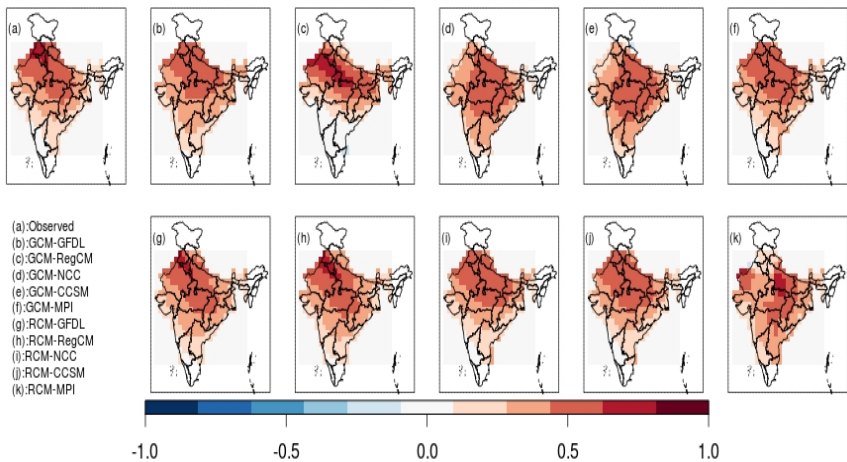
Projections from Regional Climate Models (RCMs)

- RCMs has scale related added value for providing simulation of key climatic variables.
- However, it is not clear whether this added value also reflects in simulation of intensity, magnitude, duration and frequency characteristics of key climatic variables.
- In addition, there are limited studies that attempts to assess the added value of RCMs to better represent climatic processes and phenomena that explains occurrence of extremes.
- However, the ability of RCMs to provide a realistic simulation of climatic features is well debated in the literature and it is not clear if RCMs have better skills than GCMs, particularly for simulation of both temperature and precipitations extremes (Racherla et al., 2012; Glotter et al., 2014; Laprise et al., 2014).

Framework for assessing the added value of CORDEX-RCMs

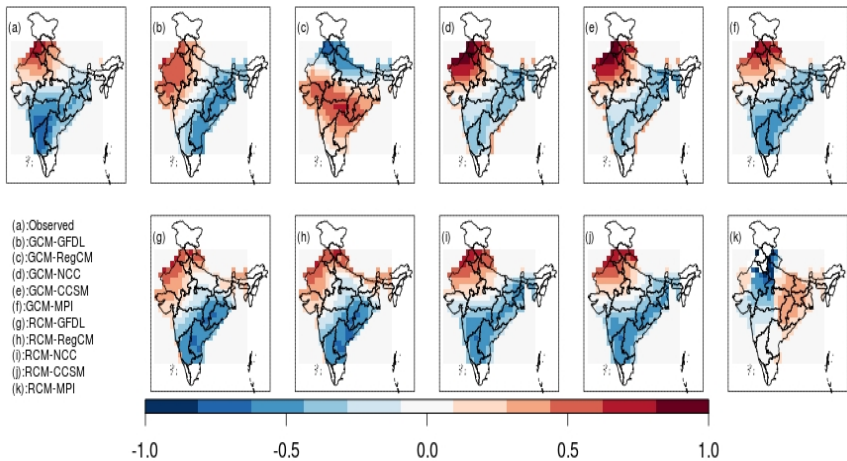


Simulation of leading mode of EOF of daily temperature data



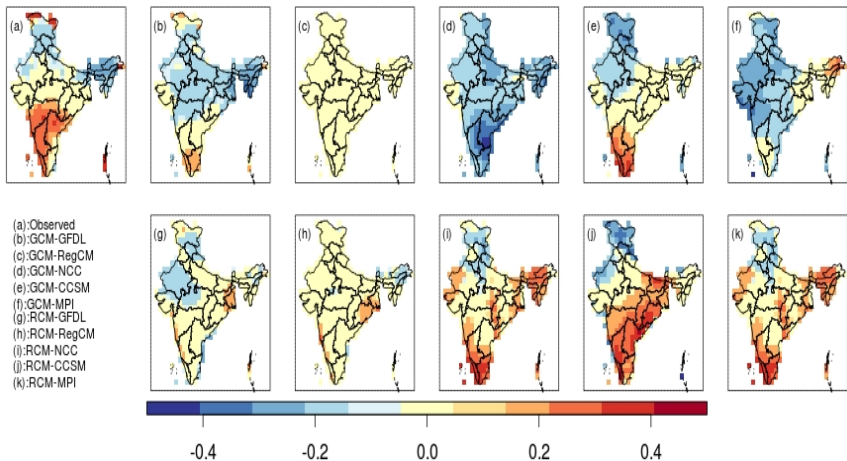
Contributors: Dr. Subimal Ghosh and Dr. Edoardo Daly

Simulation of second leading mode of EOF of daily temperature data



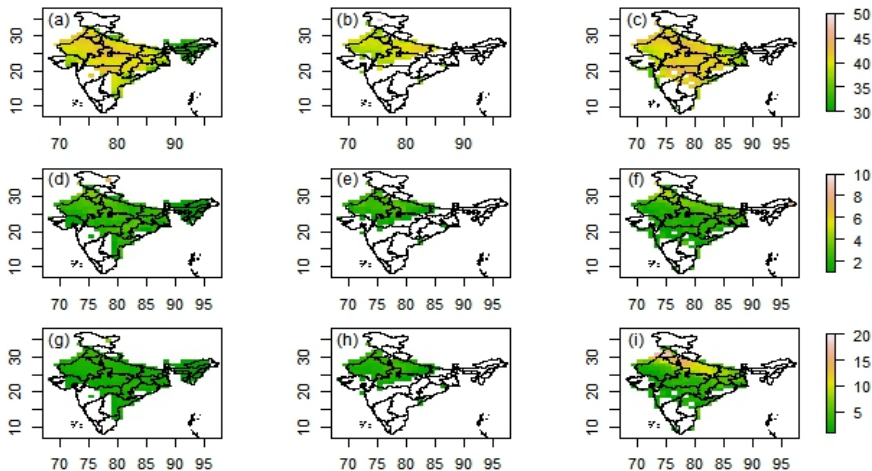
Contributors: Dr. Subimal Ghosh and Dr. Edoardo Daly

The relationship of SST variability of Indian ocean region



Contributors: Dr. Subimal Ghosh and Dr. Edoardo Daly

Impact of extreme temperature on wheat yields



Contributors: Dr. Subimal Ghosh and Dr. Edoardo Daly

Issues for evaluation of added value of CORDEX RCMs

- Unavailability of appropriate framework for evaluation added value of RCMs.
- There is no framework that can address the separation good RCM and not good RCM (or weighting RCMs based on performance in relation to observed data) from a set of ensembles
- It is not yet clear whether RCMs has added value than statistical downscaled product obtained from driving GCMs
- RCMs has a similar magnitude of bias as of their driving GCMs. There are plenty of bias correction approached. For users it is not clear which bias correction method should be used.

Conclusions

- Temperature extreme is one climatic information that is well evident to relate with the impact on electricity demand, crop yield (both at macro and micro scale)
- Impact assessment studies emphasized the need of daily scale information along with spatial detail for better applicability of approaches.
- There is no framework available that guides users to evaluate RCMs or assess the added value of RCMs.
- In our study of assessment of added value of CORDEX-RCMs we find both GCMs and RCMs has similar skill to simulate heat wave characteristics of north India.
- Our study suggest CRODEX-RCMs adds values for simulation of heat wave characteristics of South India. It provides better physical explanation of occurrence of extreme temperature conditions in South India.

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